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ABSTRACT

This short teaching unit presents broad topics dealing with natural resource management and the impacts of man, historically and currently, on the ecosystem. A broad format has been used to facilitate adaptation of the topic to individual school systems and grade levels. An effort has been made to specifically integrate selected disciplines into the topic. Notes are provided in the teaching unit which suggest modifications for grade levels. All suggested activities have been field-tested in public schools. The unit includes learning concepts: behavioral objectives: class discussions: questions, supportive activities, and a detailed example activity: and a glossary of terms. (RE)

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Man's Manipulation of the Ecosystem

A Curriculum Guide for Elementary and Secondary Teachers

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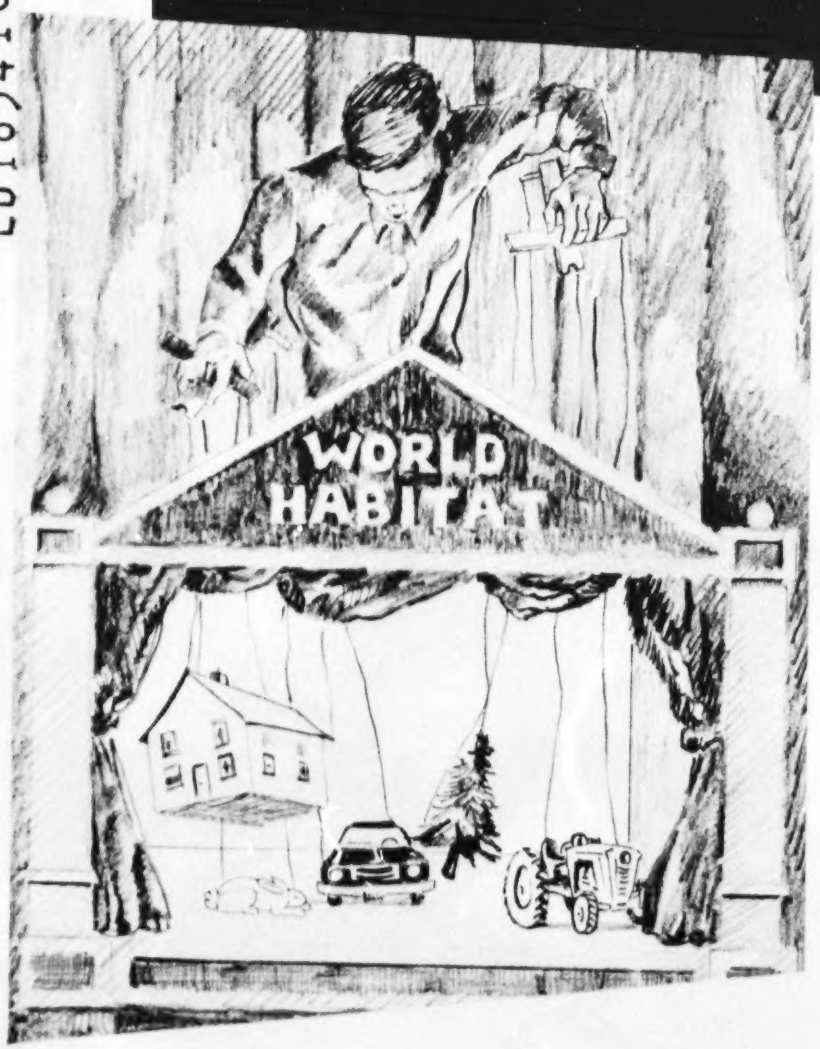

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Wildlife Education Unit

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INTRODUCTION

This Wildlife and Environmental Education Teaching Unit has been developed under the auspices of U.S. Office of Environmental Education. The need for this educational package was recognized after the New Jersey Division of Fish, Game, and Wildlife conducted several Teachers Workshops regarding natural resource management. It became apparent that very little curriculum material was available that dealt with resource management in a way that included man as user and manager of these resources. Within this shortcoming was an even greater assumption that certain student entrance level skills and knowledge were firmly established when, in fact, they were almost non-existent! Hopefully, this material will help overcome these problems.

The topics covered are somewhat controversial in focus but rather straightforward in content. A broad format has been chosen so that it can be easily adapted to meet the needs of individual school systems. Although most of the topic areas have a science orientation a special effort has been made to include Humanities, Social Sciences, Arts and Math activities.

Originally, the project intended to develop separate activities for both the elementary (targeted for 5th. grade) and secondary (targeted for 10th. grade) levels. However, during the course of the work, it became apparent that many of the activities overlapped these grade levels and could be easily adapted to meet the needs of upper or lower grade levels. To avoid duplication we elected to combine the curriculum into one booklet.

We have included suggested grade levels with each activity; however, these are only guidelines. The activities were written with the teacher in mind and not as something to be handed directly to the students.

All of the activities have been tried and tested within selected school systems.

The accompanying evaluation sheet will aid us in making further improvements in the project.

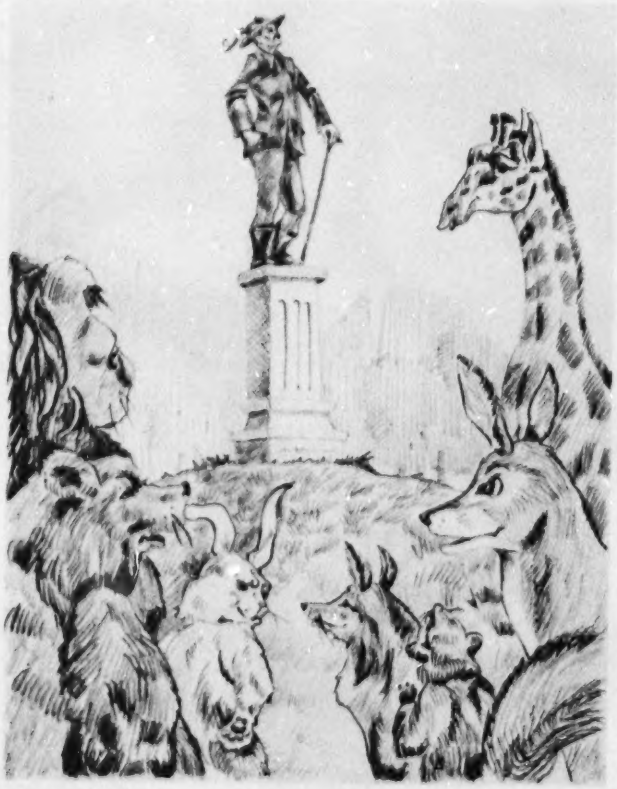
Your evaluation will be greatly appreciated.

Robert Byrne

MAN'S MANIPULATION OF ECOSYSTEM

Common Misunderstanding:

Man is viewed as operating in a realm that is completely separate from the "natural" world.

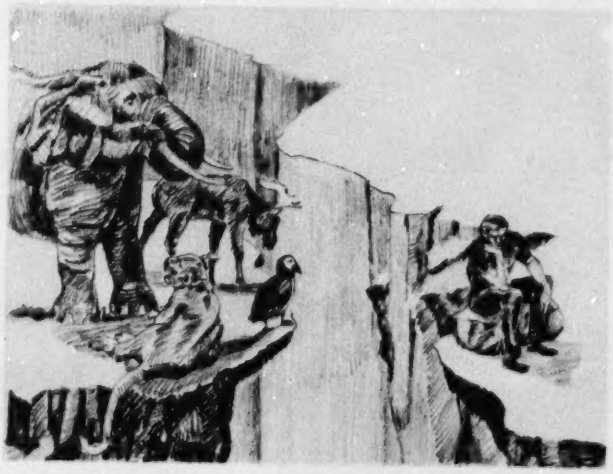


Resultant Problem:

Man's interactions with ecosystems are largely viewed from a negative perspective. Very little thought is given to the *total* impacts, both positive and negative, that man's everyday activities have on the ecosystem.

Learning Concept Needed:

Man is a member of the ecosystem. Virtually every activity that people undertake has both negative *and* positive effects on the ecosystems' ability to produce the necessary ingredients to support wildlife *and* humans. The short and long term effects of any given activity must ultimately be judged against the current and future needs and wants of society.

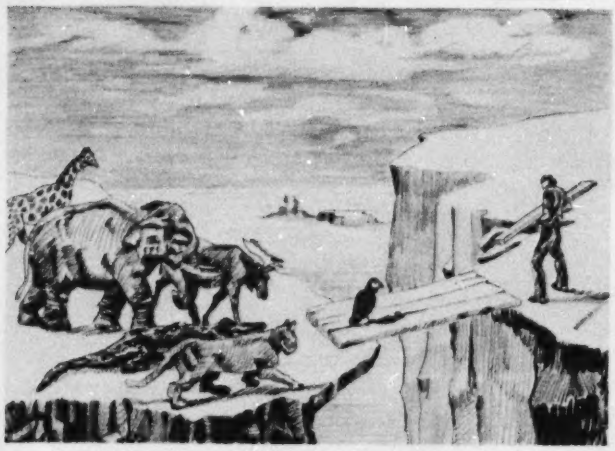


Concepts: (Umbrella Ideas)

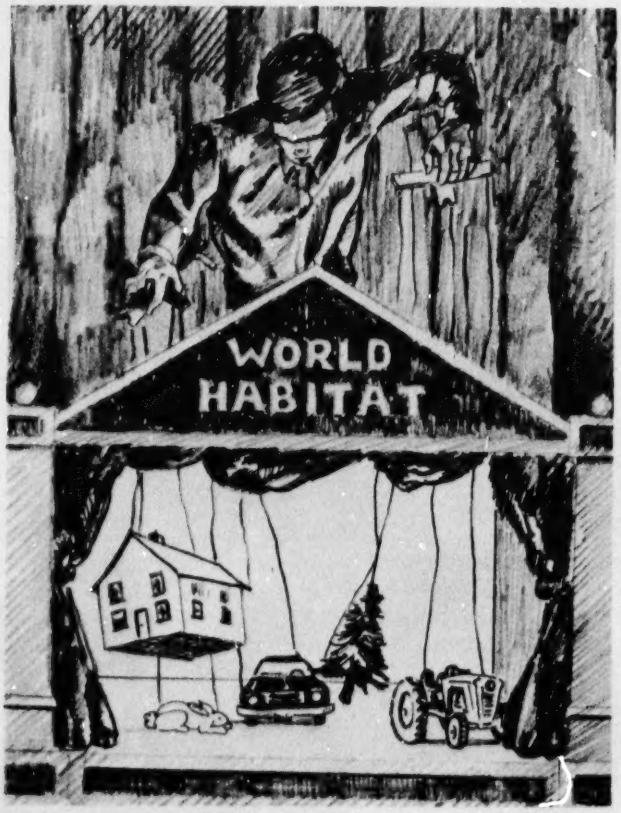
1. Eons ago man was no different than any other wild animal. He foraged and hunted for his meals without any significant effect on the ecosystem. When man stopped hunting and began farming, his interests and activities altered the populations of wildlife.
2. As technology provided man with the means (weapons, farm machines, and pesticides, etc.), he systematically changed many wildlife populations through the alteration of ecosystems by direct or

indirect measures.

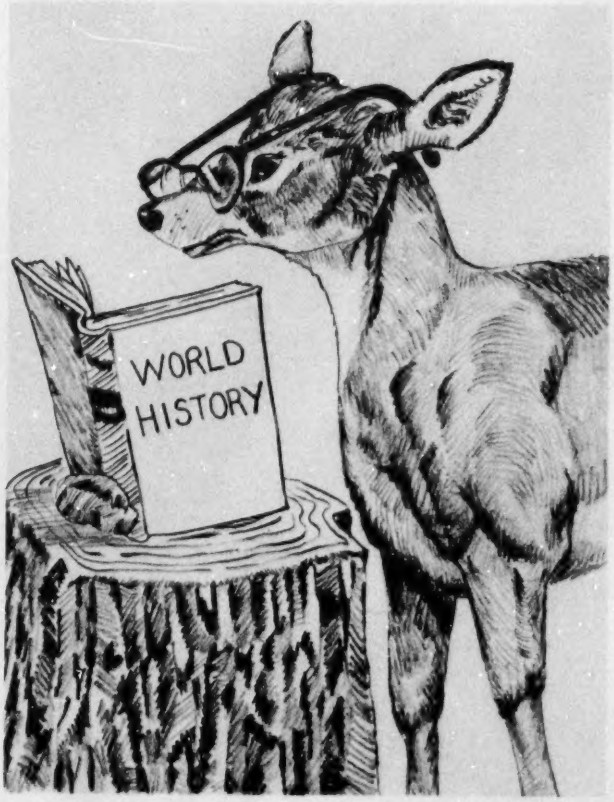
3. Although many wildlife species (many predators) have been eliminated from their former ranges, other species have increased their geographic ranges and numbers as a result of habitat changes by man.



4. As man's technology and society increased his perceived "separation" from the "natural" world widened. That same technology is now telling us that that perceived separation is largely fictitious. Current and future interactions with "our" world will have to be carefully weighed so that the overall productivity of the ecosystem is not diminished significantly.



5. Natural ecosystems are complex and possess many habitats occupied by a few members of a wide variety of animal species. Alteration of a habitat whether by building a city or a shopping center or cultivating a field drastically reduces the number of different (variety) habitats and *simplifies* that ecosystem. By simplifying and altering a habitat, few *individuals* of a wide variety of species changes to many *individuals* of a few species. A "natural" forest ecosystem with many species of birds, mammals, reptiles, amphibians, and insects transformed into a city will have those animals replaced by large numbers of a few species—rats, roaches, flies, pigeons, starlings, and English sparrows. The same forest transformed into a corn field will discourage the survival of forest organisms and promote large numbers of a few species that are adapted to corn fields—blackbirds, corn borers, crows, and doves. Ecosystems with great diversity (the forest) are relatively stable because there are many paths (many species) in the food web. Ecosystems with only a few species are relatively unstable (corn field) having few paths or feeding alternative in the food web. Simple, unstable, ecosystems are subject to ecological disasters (i.e. algae blooms, grasshopper epidemics, boll weevil attacks, etc.).



6. By knowing the preferred habitat requirements of selected wildlife species, man can manage those species through habitat manipulations. For example, by providing pollution-free wetlands, suitable food webs will be naturally established that will support waterfowl, muskrat, beaver, otter, marsh

hawk, short-eared owl, song sparrow, marsh wren, and other aquatic related species. By providing brushy buffer zones between open areas on farms and forests (ecotones) will create habitat for many species such as rabbits, snakes, song birds, quail, butterflies, and many others that seek a brushy habitat. Proper forest management can promote deer, wild turkeys, and gray squirrels.

Behavior Objectives

The student will be able to:

1. describe man's place in the ecosystem.
2. describe some historic land use changes and how they have affected wildlife populations (two positive population changes and two negative population changes)
3. describe the relationship between the complexity of an ecosystem, the variety of wildlife species living there and the relative numbers of each species present (the relationship between habitat and wildlife populations)
4. describe some modern ecosystem manipulations and the beneficial or injurious effects to the human environment.

Class Discussions

Man is a living animal just like all the others in the biosphere and is an integral part of all ecosystems. However, unlike most other wild animals, man has the ability to and does alter the ecosystems with which he is associated. Virtually everything man does affects wildlife populations in one way or another. Most of man's actions have been viewed to have detrimental effects on wild populations, and such is the case with habitat destruction and pollution. However, many of man's alterations of the ecosystem have benefited certain wildlife populations. With proper conservation practices, man can live in harmony with most wildlife species.

Developing civilizations and spiraling human populations have had and continues to have a profound effect on the environment. The Indian cleared forests to raise crops. Later the European settlers removed more forest communities to build their new settlements and obtain farmland. Why were these millions of acres cleared? It was to benefit *man*. The farmland they created was more productive for satisfying *human* food needs than the existing forest land. Clearing the forest, however, resulted in the destruction of habitat for countless other organisms that depended upon a forest habitat. Because these individual organisms lost the habitat in which they needed to live, they died. Other organisms that were adapted to cleared or farmed habitats replaced them in the farmed land.

Man has tried to acquire optimum benefit from his environment. He has drained wetlands, irrigated dry lands, burned and cut forests, built cities, towns, airports, industrial plants, elaborate highway systems, military bases and countless other things. All of these constructions altered "natural" communities. The wildlife populations changed as the plant communities changed.

Show Slides Depicting:

1. Forest Area—changing to—Housing Development
2. Swamp Area—becoming an—Industrial Plant
3. Swamp Area—becoming a—Pond
4. Grassland Area—becoming a—Cultivated Farmland

Questions:

1. What wildlife (species) would you likely find in:

   a) The forest area—Why?

   ANSWER: animals: gray squirrel; chipmunk; wild turkey; piliated woodpecker; various song birds; various butterflies; deer; mice; ring necked snake; box turtle; various salamanders; deerflies.

   b) The swamp area—Why?

   ANSWER: various ducks, muskrat, otter, water shrew, water snake, painted turtle, various frogs, mosquitos.

   c) The grassland area—Why?

   ANSWER: moles, black snakes, field mice, grasshoppers, field sparrow, meadow larks, quail, rabbits.

   WHY? (for all questions) Because of habitat availability (food, cover, water, and living space).

2. What wildlife would you likely find in:

   a) Housing Development—Why?

   ANSWER: starlings, rabbits, butterflies, robbins, moles, etc.

   b) Industrial Plant Area—Why?

   ANSWER: rabbits, pigeons, starlings, rats

c) Ponds—Why?

ANSWER: various fish, turtles, frogs, insects

d) Cultivated Farmlands—Why?

ANSWER: spiders, blackbirds, mice, pheasants, rabbits

WHY (for all questions) Habitat requirements (food, cover, water, and living space).

NOTE: All populations are somewhat reduced, because of simplified food chains.

3. Which changes caused the most dramatic environment change?
4. Which change was most beneficial to man? What has he lost?
5. Which change was most beneficial for wildlife?

NOTE: The answers to these questions must be tempered to the individual class, their values, expectations, etc. The class should decide (define) what is "beneficial" or "dramatic".

All living organisms depend on their specific environment to provide food, water, shelter, and living space. Without these components they cannot exist. Wildlife is a product of the land. When habitat is altered, a change in wildlife populations and/or population density occurs.

Man's manipulation of the ecosystem is often viewed as being totally negative. This is not always the case. Biologists have studied man's manipulation of ecosystems to determine the effects. They can also purposely manipulate the environment to change negative consequences into positive ones.

Visit a Wildlife Management Area if possible. There you will observe first hand management practices which promote certain wildlife. Since man has active control of the environment to some extent, and man can drastically alter it, he must promote wise management practices to insure the continuous productivity of an area. This isn't a job for professional biologists only, but for everyone.

Most people are just beginning to realize how much they depend on nature. Urban Americans who rarely leave their cities and towns depend on our ranches, farmlands, and coastal areas for food. They don't want to drink polluted water. They need products made from trees. Their specific environment has been so altered that they cannot produce these products themselves. The unexpected consequences of man's manipulation of the ecosystem can create environmental problems. The problem will continue to occur if man continues to be careless or unaware of the results of changes that he institutes.

APPLY:

Choose an area outside of your school building. Change that area through plantings and cuttings so that it will support and promote wildlife. Talk to your principal, explain your reasons for wanting to undertake such a valuable project. References 2, 6, 16, 25, 29, 31, 32, and 34.

1. Decide what wildlife is likely to be in your area. Estimate populations, mark and recapture (math).
2. Research food habits and preferred cover for those animals. (Eng. lit.) write report.
3. Visit local garden shops to get fruit bearing shrubs, trees, etc. donated to the school for your project. Cut local shrubs—root them in soil and plant.
4. Build bird feeders.
5. Plant small patches of a variety of grain crops.
6. Build a few brush piles for rabbits.
7. Talk to your janitor. Ask him not to mow the grass in your habitat areas.
8. Go home and do the same thing in your backyard.
9. Ask the Town Park Commission not to clean out brushy areas so that additional habitat may be maintained.

Begin keeping a log of all wildlife that appears. Take special notice to see how these animals are adapted to their specific environment.

Supportive Activities:

(Secondary)

1. Research some of the following wildlife species to determine how their populations have changed since the Europeans arrived in America: white-tailed deer, beaver, turkey, bald eagle, osprey, peregrine falcon, passenger pigeon, American bison, house sparrow, nutria, whooping crane, starling, rat or any others suggested by the students or teacher. Find out how the numbers and geographic ranges have changed and if and how any of the changes can be related to the direct or indirect activities of man. (Hint: look at the habitat requirements of the species that you choose.) References 2, 3, 11, 12, 28, 29, 30, 33, 34, 37, and 38.

(Elementary and Secondary)

2. Take a field trip to a "natural" ecosystem (forest, pond, stream, old field or other convenient area), a city block or shopping center and a farm. Divide the class into teams that will each survey and count the number of species and individuals of the various types of organisms present at each location.

   (NOTE: Names of the various organisms are unimportant; the recognition that they are different is!) One team can do trees, another birds, another vertebrates other than birds, another insects, another invertebrates other than insects, etc. The survey should demonstrate that the natural community will have a wide variety of species with a few individuals representing each where the habitats altered by man will have the opposite—few species and many representatives of each. Plant diversity animal diversity. References: 11, 12, 14, 20, 28 ,29, 30, 32, and 34.

(Secondary)

3. Choose a highly developed area around your school (or your school grounds) and trace its development and historic land use back as far as possible. Use real estate transfer records, tax records, newspapers, photos, senior citizens, etc. to try and reconstruct its past history. Equate these land use practices with the effects that they had on the wildlife populations (habitat) occurring at that time. After that is complete pick an area that is threatened with development and try and predict what will happen to the wildlife populations in that area. How does the presence of wildlife affect the "Quality of Life" for the humans living in the area?
   References: 1, 2, 3, 6, 11, 16, 18, 20, 28, 29, 30, 33, 34, 35, 37, and 38.

(Elementary and Secondary)

4. Assign an *arbitrary* "value" (i.e. cost) in terms of wildlife and wildlife habitat to the school building (or any other human alteration of the ecosystem) that you are in. Keep in mind all of the resources that went into the construction of that building (i.e. cement, steel, plastic, electricity, and other energy forms, glass, transportation systems, human labor, food for human labor, heavy equipment, etc.) Play around with the "cost-value" in each category until it is too much to "pay" for the structure. Then discuss the interrelationship between all segments of society, the natural resources that man uses, and a "healthy environment."

EXAMPLE: SCHOOL BUILDING

Resources needed to build school	**Habitat Cost**
Steel	
Made from Iron Ore mined in Wisconsin	22 rabbits
Used coal to make the steel	2 eagles
Needed blast furnace to make the steel	1 elk & 3 wolves
Transportation system to deliver the steel	87 rabbits
Electricity	
Power Plant	?
Coal	?
Wires to transport	?
Et. al.	?

The "value-cost" assigned to each species is *arbitrary*. The purpose of this activity is to make people realize that man's indirect activities, his needs and wants result in habitat change. Habitat change, in turn, affects wildlife populations. The bottom line is *human needs*.

(Elementary and Secondary)

5. Construct an oral history of the local area by interviewing senior citizens who have resided in the area for most of their lives. The history should emphasize the land use changes that the area has undergone. How have these changes affected the wildlife population? The present residents? The future residents? (These questions should lead to an open ended discussion concerning human needs and ecosystem diversity.)

(Elementary and Secondary)

6. Visit a Wildlife Management Area (either a Federal Refuge or State Management Area) to see how the habitat is manipulated to encourage wildlife populations. (See appendix for a list of available areas).

(Elementary and Secondary)

7. Rewrite the history of the Western Expansion and settlement of North America in terms of habitat change and its corresponding effect on wildlife populations. Continue the "history" up to the present time and be sure to include both positive and negative impacts on the populations. Make a bulletin board display of the findings.
References: 1, 2, 3,9, 12, 20, 28, 29, 30, 33, 34, 35, 37, and 38.

(Elementary and Secondary)

8. *Make a collage* depicting man in the ecosystem. Try and include all the activities that go into food gathering, obtaining clothing, building shelter, recreation, etc. While gathering materials for the collage keep in mind and think about this quote from Aldo Leopold's book, *A Sand County Almanac.*
"Wilderness is the raw material out of which man has hammered the artifact called civilization."
Discuss how these activities have altered the environment.
How have the wildlife populations responded to these changes? What have been the human benefits and liabilities resulting from these changes?
References:1, 3, 12, 28, 33, 35, and 38.Various magazines and newspapers.

(Elementary and Secondary)

9. Consider and discuss the short and long term effects of the following activities on the ecosystem, the wildlife populations and the corresponding human populations. Be sure to include energy usage, transportation, building construction, etc. in your considerations.

   a. Building a new home.
   b. Throwing out your garbage.
   c. Walking on the grass in the park.
   d. Building a four lane highway.
   e. Plowing a grass field and planting corn.
   f. Draining a swamp and building a shopping mall or housing development.
   g. Buying new clothes.
   h. Setting aside a large piece of land for a "wilderness" area.
   i. Driving to the country and having a picnic lunch.
   j. Damming a stream to make a lake.
   k. Riding your bike to the store.
   l. Channelizing (straightening) a stream.
   m. Cutting a dead (or live) tree for firewood.
   n. Visiting a museum.
   o. Eating a hamburger at a local restaurant.

(**NOTE:** There are no real "answers" to these impacts. This activity is designed to probe the students and make them recognize the complexity of ecosystem management and the many considerations that must be given before any action is undertaken.)

(Secondary)

10. Research how American Indian cultures interacted with the ecosystem and how these actions affected wildlife populations.
References: 1, 9, and 35.

APPENDIX I

GLOSSARY OF TERMS

Animal—a living organism that is not a plant. Generally *it is not* able to manufacture its own food and *is* capable of voluntary motion.

Biosphere—that area on earth which can support life.

Biotic Diversity—a relative measure of the complexity of an ecosystem determined by the number of different *species* (plant and animal) found in a community. Often *plant diversity* and *animal diversity* are discussed separately, but are directly related.

Biotic Potential—the maximum possible growth rate of an animal population (high birth rate, low death rate).

Biotic Pyramid—Herbivore—an animal that eats only plants.
Carnivore—an animal that eats only meat (other animals).
Omnivore—an animal that eats plants and meat.

Carrying Capacity—the number of animals (usually used for a single species) that the habitat can support.

Community—all the plant and animal populations occupying a given area.

Conservation—the wise use of natural resources.

Consumer—an organism that uses the stored energy of another organism for food. Generally prefaced by a) primary (the first) or b) secondary (the second).

Cycle—fluctuations in animal populations as related to time and number of animals.

Decomposer—an organism that participates in the nutrient recycling process of decay.

Ecology—the study of the relationships that exist between living things and their environment.

Ecosystem—the combination and interaction of both the living and non-living aspects of community. This concept can be expanded to global situations or shrunk to microscopic proporations depending upon the context in which it is used.

Ecotone—the place where two major types of communities meet and blend together.

Endangered—a species whose prospects of survival and reproduction are in immediate jeopardy.

Extinct—a species that has no living representative.

Food Chain—the path by which energy and materials are cycled through the environment. Eating and being eaten.

Food Web—complex combination of several to many food chains.

Habitat—the kind of place where living things (plants and animals) live.

Home Range—the area in which an individual spends all or most of its time.

Limiting Factors—the things in a habitat that are needed by an animal population, but are in short supply, thus limiting the carrying capacity of the habitat.

Natural Resource—anything used that is not man-made.
Renewable—able to reproduce itself; living
Non-renewable—unable to reproduce itself; non-living

Niche—the function (i.e.: job or occupation) that an individual or species performs within a community.

Photosynthesis—the process by which complex organic materials are manufactured in plants using carbon dioxide and water as ingredients and sunlight as the energy source. More generally, the process by which sunlight energy is "captured" and "stored" in plants.

Plant—an organism that *is* generally capable of manufacturing its own food through photosynthesis (however there are non-photosynthesis plants, i.e.: mushrooms), and *not* capable of voluntary motion. (NOTE: in lower forms of life these characteristics do not always hold up).

Population—the total number of animals of a single kind (species) that live in a common geographical area.

Population Dynamics—changes in a wildlife population over time in both numbers and composition.

Predator—an animal that survives by killing other animals for food.

Prey—an animal that is commonly killed by predators for food.

Primary Producer—an organism (plant) that changes sunlight energy into food energy that can be used by other organisms in the food-chain.

Rare—that although not persistently threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environment worsens.

Refuge—an area of land managed for the preservation of an animal species and/or its habitat.

Species—a class of individuals (plant or animal) having common characteristics. Usually associated with an organism that breeds "true to form."

Stress—(Shock Disease) a physiological response, within an animal, to adverse changes in the environment.

Succession—a sequence of communities which replace one another in a given area.

Territory—any defended area.

Turnover Rate—the rate at which new (young) individuals replace old in a population.

Wildlife—any animal that is not dependent upon man for survival or that man does not intentionally take care of.

Wildlife Management—the science and art of changing the characteristics and interactions of habitats, wild animals populations, and men in order to achieve specific human goals by means of wildlife resources.

APPENDIX II List of State and Federal Wildlife Areas in New Jersey

Federal	Location
Barnegat	Barnegat
Brigantine	Brigantine
Great Swamp	West of Chatham
Kill Kilcohook	South of Pennsville

State	Location
Absecon	Absecon
Amwell Lake	East of Linvale
Assunpink	Assunpink
Baldwin Lake	North of Pennington
Beaver Swamp	South Dennis & Swainton
Berkshire Valley	Northwest of Dover
Edward G. Bevan	South of Millville
Black River	Northeast of Chester
Butterfly Bogs	Holmansville
Capoolong Creek	South of Hamden
Cedarville Pond	Cedarville
Clarks Pond	South of Bridgeton
Clinton (Spruce Run)	North of Clinton
Colliers Mills	Colliers Mills
Dennis Creek	Dennisville
Dix	Adjacent to Del. River
Egg Island—Berrytown	Adjacent to Del. Bay
Flatbrook	Bevans
Fortescue	North of Fortescue
Glassboro	South of Glassboro
Great Bay Boulevard	Tuckerton
Greenwood Forest	Whiting
Hainesville	North of Hainesville
Hamburg Mtn.	Hamburg
Harrisonville Lake	Harrisonville
Heislerville	West of Heislerville
Imlaystown	Imlaystown
Ken Lockwood Gorge	North of High Bridge
Lester G. MacNamara	Tuckahoe
Logan Pond	South of Gibbstown
Mad Horse Creek	South of Canton
Manahawkin	East of Manahawkin
Manasquan River	Herbertsville
Manchester	East of Manahawkin
Marmora	Marmora
Maskells Mill Pond	East of Canton
Medford	Medford Township
Menantico Ponds	East of Milltown
Nantuxent	West of Cedarville
Pasadena	South of Pasadena
Peaslee	East of Millville
Pequest	Pequest
Port Republic	North of Port Republic
Prospertown Lake	Prospertown
Rowands Pond	South of White Horse Pike
Stafford Forge	Eagleswood & Little Egg Harbor Twp.
Swan Bay	New Gretna
Turkey Swamp	South of Freehold
VanNest Refuge	Trenton
Walpack	West of Walpack Center
Wanaque	South of Sterling Forest, NY
Whiting	Southeast of Whiting
Whittingham	Fredon & Green Townships
Winslow	North of Winslow-Williamstown Rd.

To assist in locating the state Wildlife Management Areas, order the guide listed below:

WILDLIFE MANAGEMENT GUIDE

The revised and expanded edition of the "Guide to Wildlife Management Areas" comprises over 120 pages of articles and maps in three colors.

Descriptions of the 56 wildlife management areas include information on locations, and hunting and fishing while the maps illustrate boundaries, wooded areas, fields, lakes, streams and marshlands. Also depicted are the access roads leading into each management area.

The guides may be purchased by sending a check or money order for $3 to:

Wildlife Management Guide
Division of Fish, Game and Wildlife
P.O. Box 1809
Trenton, N.J. 08625

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Recommended Films

The Farm 28 min.—color

Farm management with wildlife considerations are shown in this unique film.

Source: Modern Talking Picture Service, 315 Sprinfield Avenue, Summit, N.J. 07901

Conservation and the Balance in Nature 18 min.—color

Investigates the dynamic balance in biological communities and man's role in changing those communities to obtain the resources he needs.

Source: International Film Bureau, 332 S. Michigan Avenue, Chicago, Ill. 60604

The River Must Live 15 min.—color

An in depth look at the biological workings of a river system, the benefits that it brings to man and the abuses that man has imposed upon its ability to purify itself.

Source: Shell Film Library, 1433 Sadlien Circle West Drive, Indianapolis, Ind. 46239

Patterns of the Wild 28 min.—color

A fox-eyed view of the dynamics of a "natural" ecosystem.

Source: State Museum, Room 25, Box 1868, Trenton, N.J. 08625

Life in the Woodlot 17 min.—color

Emphasizes the relationship and interdependence of man, animals, and plants.

Source: State Museum, Room 25, Box 1868, Trenton, N.J. 08625

NOTE:

The attached evaluation encompasses all the five topic areas within the project. If you have not received all of the topics, please fill out and return the evaluation for only those areas you have received.

SCHOOL NAME _____ GRADE _____

ADDRESS _____ AGES OF STUDENTS _____

TEACHERS NAME _____ NUMBER OF STUDENTS _____

NUMBER OF MALES _____

NUMBER OF FEMALES _____

1. Have you attended a Teachers Wildlife Workshop sponsored by the Division of Fish, Game, and Wildlife? yes____ no____
2. If you answered yes, please indicate the place and date.
   _____
3. Is Environmental Education part of your school curriculum?
   yes____ no____ If yes, what grade level?_____
4. Please indicate the order in which the Concept units were taught.
   (1 = first, 5 = last) Leave blank if unit was not taught.

   Energy in the Ecosystem_____
   Population Dynamics_____
   Wildlife as Envir. Indi._____
   Current Wildl. Problems_____
   Man's Manipulation of Ecosystems_____
5. In the future, would you teach the concepts units in the same order as above? yes____ no_____
6. If not, please indicate the order in which you would most likely follow in the future.

   Energy in the Ecosystem_____
   Population, Dynamics_____
   Wildlife as Envir. Indi._____
   Current Wildl. Problems_____
   Man's Manipulation of Ecosystems_____
7. Please indicate the amount of time spent on each concept and include field trips, etc.

   Energy in the Ecosystem_____
   Population Dynamics_____
   Wildlife as Envir. Indi._____
   Current Wildl. Problems_____
   Man's Manipulation of Ecosystems_____
8. In which subject areas were the concepts integrated?

	yes	no
Science	_____	_____
Math	_____	_____
Social Studies	_____	_____
Art	_____	_____
English	_____	_____
Other_____	_____	_____

9. Do you feel that using wildlife as a medium for teaching environmental education helped stimulate your students interest?
   yes_____ no_____
10. Did any guest speakers talk to your class as part of this program?
    yes_____ no_____
11. If you answered yes to the above question, please list below the speaker's name, affiliation and the topic of which he/she spoke.
12. Would you recommend this manual to other teachers for their use?
    yes_____ no_____
13. If you answered no to the above question, please state your reasons on the back of this page.
14. This manual discussed five environmental concepts. If there are other concepts that you would like to see included in this manual, please list them below.

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15. Consider the entire environmental education manual. How would you rate the following aspects of the manual?

	adequate	Inadequate (needs improvement)
discussion of ideas	_____	_____
explanation of terminology	_____	_____
wildlife examples	_____	_____
suggested readings and references	_____	_____
experiments	_____	_____
classroom activities and exercises	_____	_____
outdoor activities and exercises	_____	_____
suggested films and slides	_____	_____

16. If you indicated that any of the above areas need improvement, please explain your reasons as well as any suggestions that will help us in the space below.

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Mail to:

Wildlife Education Unit
Division of Fish, Game & Wildlife
State Fish Hatchery
Hackettstown, N.J. 07860

The following section deals with each concept unit and the main ideas presented as part of that unit. The first column asks for an evaluation of the idea by the teacher. The second and third column asks for a judgement on your classes knowledge of the idea before and after this concept was taught. Please circle the appropriate response. Additional comments to help us improve this manual are welcomed.

STATEMENT	EVALUATION					PRIOR KNOWLEDGE				PRESENT KNOWLEDGE			
a = adequate i = inadequate	discussion	films/slides	classroom activities	outdoor activities	readings & references	excellent	good	fair	poor	excellent	good	fair	poor
ENERGY IN THE ECOSYSTEM													
the sun is the primary energy source for all life on earth	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
all food & energy is derived from ecosystems	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
life-death-birth is an energy transfer process upon which all organisms depend (including man)	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
POPULATION DYNAMICS													
animal populations fluctuate in response to environmental influences (dynamic balance)	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
animal populations are regulated by limiting factors	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
wildlife is a renewable natural resource	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
WILDLIFE AS AN INDICATOR OF ENVIRONMENTAL QUALITY													
the term "wildlife" includes all undomesticated animals both vertebrates & invertebrates	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
animals exist in habitats which provide their living requirements	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
man can use certain animals as indicators of environmental quality	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
man too has living requirements which must be fulfilled in order to survive in a particular area	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
CURRENT WILDLIFE PROBLEMS													
wildlife like other renewable resources can be harvested indefinitely if managed properly	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
habitats can be managed to increase their ability to support wildlife	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
wildlife species become endangered for several reasons— the most common of which is destruction of suitable habitat	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
wide scale use of pesticides has adversely affected many wildlife species	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
the "American standard of living" can both hinder & help the plight of endangered species	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
MAN'S MANIPULATION OF ECOSYSTEMS													
animals exist in habitats which provide their living requirements	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
man changes ecosystems to provide for his own living requirements	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
when man changes ecosystems he also changes the wildlife populations that are associated with those ecosystems	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p

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